A TRANSIENT NON-BREEDING POPULATION OF *DANAUS PLEXIPPUS* (L.) (LEPIDOPTERA: NYMPHALIDAE) NEAR PICTON, NEW SOUTH WALES

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Abstract

Data on a non-breeding population of *Danaus plexippus* (L.) at a site near Picton, New South Wales, were obtained during April and May 1981. The colony was characterized by substantial immigration and emigration and is considered to have been formed by migrating individuals en route to overwintering sites in the Sydney basin.

Introduction

The Monarch or Wanderer butterfly *Danaus plexippus* (L.) overwinters in the Sydney area in either a breeding or non-breeding condition (Smithers 1977; James 1981). Non-breeding populations form clusters at specific sites which are used annually (Smithers 1965; James 1979). Butterflies remain at these sites for two to three months before becoming reproductively active and dispersing. Migration precedes cluster formation, although the distances travelled are probably small in comparison to the extensive migrations of the same species in North America (Urquhart 1960, 1976; James, in press). A characteristic of the autumn migration of *D. plexippus* in North America is the occurrence of large transient roosting colonies en route to the overwintering areas (Urquhart 1960). Transient non-breeding populations have also been recorded during winter in California (Tuskes and Brower 1978).

This paper presents information obtained on a transient non-breeding population of *D. plexippus* that occurred in 1981 near Picton, New South Wales.

Methods

The study site located 5 km west of Picton is occupied annually by non-breeding populations of *D. plexippus.* The butterflies congregate at the southern end of a north-south oriented valley at an altitude of about 250 m. Protection from southerly and westerly winds is given by the valley sides at the southern end which rise to 330 m. A group of small trees and bushes are used by the butterflies for roosting and consist mainly of *Melaleuca styphelioides* S.m. (Myrtaceae), prickly leaved tea tree, and *Lantana camara* (L.) (Verbenaceae), lantana. Larger trees (*Eucalyptus* spp.) in the area are occasionally used. The area is about 30 m long and 10 m wide.

Early morning visits between the hours of 6 and 9 a.m. E.S.T. were made to the site at fortnightly intervals from 29th March to 14th June, 1981. A sample of butterflies was taken at each visit by dislodging inactive clustering individuals into a net. Individuals were marked using the alar tag method of Urquhart (1960) and released back into the population. Tags were numbered consecutively and showed a telephone number for contact. The condition of butterflies was arbitrarily assessed as poor, good or excellent using the

degree of wing scale loss and fading as criteria (James 1981). Females were gently squeezed posterio-dorsally to determine their mating status by the presence or absence of spermatophores in the bursa copulatrix. A small number of females were dissected to provide evidence of the non-reproductive condition of the population. Estimates of the population were made by counting individuals in the clusters while they were inactive. The small area of the site and the discrete clustering behaviour of the butterflies allowed a probable high degree of accuracy in these estimates. Data on sex ratios, cluster positioning, feeding behaviour and temperatures were also obtained.

Results

A non-breeding population of *D. plexippus* occupied the site during a four week period from 12th April to 10th May. It was not present on 29th March or 31st May. An estimated 400-700 individuals made up the population on each of three visits.

The condition of butterflies remained good to excellent throughout the period (Table 1). On 12th April many individuals had wing undersides which were faded, contrasting to the mint condition of the upper surfaces. Similar fading has been seen in individuals exposed to rain (James, unpublished data). Heavy rain occurred in New South Wales during the first week of April. Only 10% of butterflies were in an excellent condition although if "rain fading" was ignored this rose to nearly 60%. The proportion of rain faded individuals fell to 12% on 26th April when butterflies in an excellent condition made up 37.5% of captured butterflies. 5% of "excellent" butterflies had wings that were still limp and characteristic of individuals in the first few days after eclosion. On 10th May 85% of butterflies were in a good condition and 13.7% in an excellent condition. Less than 1% were rain faded on this date.

TABLE 1: Data on a non-breeding population of *D. plexippus* near Picton in 1981.

Date	Number in sample	Number tagged	Number recaptured (with %)	Sex ratio (%) ♂	♀	Condition (%) poor	good	excellent	Estimated population
29 March	–	0	–	–	–	–	–	–	0
12 April	161	155	–	94.4	5.6	2.5	87.6	9.9	600-700
26 April	128	119	2 (1.3)	87.5	12.5	0.8	61.7	37.5	400-500
10 May	241	227	10 (3.6)	82.6	17.4	1.2	85.1	13.7	500-600
31 May	–	0	0	–	–	–	–	–	0
14 June	–	0	0	–	–	–	–	–	0
TOTAL	530	501	12 (2.4)	87.3	12.7	1.5	80.2	18.3	1500-2000

The sex ratio of the population was considerably imbalanced in favour of males (Table 1). On 12th April females made up only 5.6% of the population but this increased to 17.4% by 10th May. Nine females examined on 12th April were unmated but only eight of 16 females captured on 26th April were virgin. Similarly 22 of 42 females taken on 10th May had been mated. Seven females, taken during the clustering period and dissected, showed varying degrees of reproductive inactivity. Four had no ovarian development while three contained immature oocytes in stages of resorption.

A total of 501 butterflies were tagged and 12 (2.4%) were recaptured at the site (Table 1). Two individuals tagged on 12th April were found dead on 20th April and 2nd May, 15 and 10 km north of the site, respectively. 155 butterflies were tagged on 12th April. Two (1.3%) were recaptured at the site on 26th April and three (1.9%) on 10th May. Seven (5.9%) of 119 butterflies tagged on 26th April were recaptured on 10th May. No recaptures were made of 241 individuals tagged on 10th May.

Clustering behaviour of the population varied in an apparent response to temperature and wind strength. On 12th April the temperature at the time of visit was 12°C and the butterflies were clustered in eight major groups on the southern, western and eastern edges of the site. On 10th May four dense cluster groups occurred in a single area at the eastern edge sheltered from a strong, cold south westerly wind. The temperature at the time of visit was 5°C. Substantial feeding activity was shown by the population on each visit. Flowers of *L. camara* which occurred in profusion at the site provided the main nectar source. Profuse fat body and body weights of up to 700 mg were found in dissected females. These weights were 100-200 mg greater than average values for reproductively active *D. plexippus* and 50-100 mg greater than normal weights of females in overwintering clusters (James, unpublished data).

Discussion

The population of reproductively inactive *D. plexippus* that occurred near Picton in 1981 was characterized by its dynamic nature and short period of site occupation. The small number of individuals recaptured at the site, together with the recovery of two away from it, suggests a high rate of immigration and emigration during the period of occupation. The discrete nature of the site, together with a relatively small and confined population of *D. plexippus* allowed comprehensive sampling and accurate visual assessments of population size. Any major change in population numbers such as that which would have occurred if immigration was not balanced by emigration would have been detected. A similar tagging programme, conducted on a static but much less easily sampled winter breeding population of *D. plexippus*, yielded a recapture rate of 30% (James 1981). Tagging studies performed on clustering populations at other sites in the Sydney are have produced recapture rates of 20-50% (James, unpublished data). A number of other observations provide further evidence of dynamism in the Picton population. The rapid decline of easily identifiable rain faded individuals which initially accounted for half of the population suggests their emigration from the site. The increase in numbers of butterflies in an excellent condition on the second sampling date, including a number still limp from recent eclosion, indicates substantial immigration. In 1979 and 1980 smaller populations of 50-300 butterflies remained for three to four months and about 20% of individuals tagged were recaptured at the site. The 1981 population remained at the site for only four to six weeks and showed a degree of dilution and

gain not seen in the previous years. Studies at other sites in the Sydney area during 1978-81 have generally shown occupation by non-breeding populations of *D. plexippus* to last for two to three months (James 1979, and in press).

It is clear that the colony of *D. plexippus* near Picton in 1981 differed from normal reproductively inactive overwintering populations in the Sydney area. It was a transient rather than a static population and could be compared to the temporary roosting colonies of migrating populations in North America (Urquhart 1960). Individuals in the colony were probably migrants en route to overwintering sites further north in the Sydney area. Further indications that the colony consisted of migrants were provided by the dominance of males and the substantial feeding activity of the population. Clustering populations of *D. plexippus* in the Sydney area usually consist of equal numbers of males and females except during the periods of formation and dispersal, when males predominate (James 1979, and unpublished data). Although feeding activity is an essential component of behaviour in clustering populations it does not usually occur at the level seen at Picton in 1981 (James 1979, and unpublished data). Migrating *D. plexippus* in North America are characterized by high body weight and substantial feeding activity (Urquhart 1960; Brown and Chippendale 1974; Tuskes and Brower 1978).

The origin of butterflies that form clusters in the Sydney area is unclear, although it is likely that many migrate from southern and western tableland areas and follow northerly and easterly flight directions (James in press, and unpublished data). Consequently, transient colonies of *D. plexippus* are likely to occur in highland areas to the south and west of Sydney prior to reaching the lower altitude coastal basin. All large, stable non-breeding populations of *D. plexippus* in the Sydney area occur at altitudes of less than 150 m (James, unpublished data).

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